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Landauer's Erasure Principle in the Quantum Domain

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Abstract:

Several publications in recent years have discussed thermodynamic processes in strongly coupled quantum systems and claimed the violation of both, Landauer's principle and the second law of thermodynamics. If true, this would have powerful consequences. Perpetuum mobiles could be built as long as the operating temperature is brought close to zero. This would also have serious consequences on thermodynamic derivations of information theoretic results, such as the Holevo bound. I will review the original discussion on the model of a quantum brownian oscillator and argue why previous treatments are erroneous. It turns out that the established correlations in quantum systems at low temperatures require a rethink of how entropy, heat and work have to be calculated. I will show that a consistent treatment resolves the paradoxical situation.

References: S. Hilt, J. Anders, E. Lutz, S. Shabbir, arXiv:1004.1599 (2010); J. Anders, S. Shabbir, S. Hilt, E. Lutz, Elect. Proc. Comp. Sci. 26:13 (2010) (arXiv:1006.1420v1)